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Claims

What is claimed is:

1. A method of selecting an optimal command node in a computing device having an insert queue containing a command node and a sorted queue containing another command node, the method comprising steps of:

5 (a) determining if the command node in the insert queue collides with the command node in the sorted queue;

10 (a)(i) if the command node in the insert queue does not collide with the command node in the sorted queue, then moving the command node in the insert queue from the insert queue into the sorted queue;

15 (a)(ii) if the command node in the insert queue collides with the command node in the sorted queue, then correcting the collision; and

(b) sorting the sorted queue according to a predetermined routine to determine an optimal command node and selecting the optimal command node.

2. The method of claim 1, wherein the computing device is a disc drive device

having a magnetic disc, wherein each command node includes information defining a range of addresses on the magnetic disc, and wherein the determining step (a) comprises, determining if the range of addresses defined by the command node in the insert queue overlaps the range of

20 addresses defined by the command node in the sorted queue, is a subset of the range of addresses defined by the command node in the sorted queue, or is a superset of the range of addresses defined by the command node in the sorted queue.

25 3. The method of claim 1, wherein the predefined routine comprises a Rotational Positioning Sorting (RPS) algorithm.

4. The method of claim 1, wherein the collision correction step (a)(ii) comprises the steps of:

30 (a)(ii)(A) determining if the command node in the insert queue fully overlaps the command node in the sorted queue;

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(a)(ii)(A)(1) if the command node in the insert queue fully overlaps the command node in the sorted queue, then extracting the overlapped command node from the sorted queue and moving the command node from the insert queue into sorted queue;

5 (a)(ii)(A)(2) if the command node in the insert queue does not fully overlap the command node in the sorted queue not, then determining if the command node in the insert queue is a subset of the command node in the sorted queue:

(a)(ii)(A)(2)(a) if the command node in the insert queue is not a subset of the command node in the sorted queue, then truncating the overlapped command node in the sorted queue such that it no longer overlaps the command node in the insert queue and moving the command node in the insert queue from the insert queue into the sorted queue.

10 5. The method of claim 1, wherein the act of moving the command node in the insert queue from the insert queue into the sorted queue comprises extracting the command node from the insert queue and inserting the extracted command node into the sorted queue.

15 6. A computer-readable media having computer-executable instructions for performing the steps recited in claim 1.

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7. A method of populating a ready queue in disc drive computing device with read/write command nodes, the disc drive computing device having an insert queue containing a command node and a sorted queue containing another command node, the method comprising steps of:

5       (a) determining if the ready queue is empty:  
          (a)(i) if the read queue is empty, moving the command node from the insert queue into the ready queue;  
          (a)(ii) if the ready queue is not empty, determining if the command node in the insert queue collides with the command node in the sorted queue:  
            (a)(ii)(A) if the command node in the insert queue collides with the command node in the sorted queue:  
              (a)(ii)(A)(1) determining if the command node in the insert queue fully overlaps the command node in the sorted queue:  
              (a)(ii)(A)(1)(a) if the command node in the insert queue fully overlaps the command node in the sorted queue:  
                (a)(ii)(A)(1)(a)(i) removing the command node in the sorted queue from the sorted queue; and  
                (a)(ii)(A)(1)(a)(ii) moving the command node in the insert queue from the insert queue into the sorted queue;  
            (a)(ii)(A)(1)(b) if the command node in the insert queue does not fully overlap the command node in the sorted queue, determining if the command node in the insert queue is a subset of the command node in the sorted queue;  
              (a)(ii)(A)(1)(b)(i) if the command node in the insert queue is not a subset of the command node in the sorted queue:  
                (a)(ii)(A)(1)(b)(i)(A) truncating the command node in the sorted queue such

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that a collision no longer exists, and

(a)(ii)(A)(1)(b)(i)(B) moving the command node in the insert queue from the insert queue into the sorted queue;

5 (a)(ii)(B) if the command node in the insert queue does not collide with the command node in the sorted queue, moving the command node in the insert queue from the insert queue into the sorted queue;

(a)(ii)(C) sorting the sorted queue according to a predetermined method to determine the optimal command node; and

10 (a)(ii)(D) moving the optimal command node into the ready queue.

8. A computer-readable media having computer-executable instructions for performing the steps recited in claim 7.

15 9. The method of claim 7, wherein the moving step (a)(ii)(A)(1)(a)(ii) comprises, extracting the command node in the insert queue from the insert queue and inserting the extracted command node into the sorted queue.

10 10. The method of claim 7, wherein the insert queue, the sorted queue, and the ready queue each comprise a doubly-linked list, and wherein the command node in the insert queue is the command node at the head of the insert queue, and the moving steps (a)(ii)(A)(1)(a)(ii) and (a)(ii)(A)(1)(b)(i)(B) comprise, extracting the command node in the insert queue from the head of the insert queue and inserting the extracted command node into the tail of the sorted queue.

25 11. The method of claim 7, wherein the predetermined method of sorting the sorted queue comprises a Rotational Positioning Sorting (RPS) algorithm.

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12. A method for managing a command node in a computing system having a microprocessor, an insert queue, a sorted queue, and a ready queue, comprising:

- (a) inserting the command node into the insert queue;
- (b) determining if the ready queue is empty:
  - (b)(i) if the ready queue is empty, extracting the command node from the insert queue and inserting the command node in the ready queue;
  - (b)(ii) if the ready queue is not empty, determining if the command node collides with any command in the sorted queue:
    - (b)(ii)(A) if the command node does not collide with any command in the sorted queue, extracting the command node from the insert queue and inserting the command node in the sorted queue;
    - (b)(ii)(B) if the command node collides with any command in the sorted queue:
      - (b)(ii)(B)(1) correcting the collision;
      - (b)(ii)(B)(2) extracting the command node from the insert queue; and
      - (b)(ii)(B)(3) inserting the command node in the sorted queue;
    - (b)(iii)(C) determining if the command node is the optimal command node in the sorted queue, if the command node is the optimal command node in the sorted queue extracting the command node from the sorted queue and inserting the command node in the ready queue.

13. The method of claim 12, wherein before inserting step (a) the command node is

25 extracted from a free list and populated with command data.

14. The method of claim 12, wherein the computing system further includes an active queue, the method further comprising:

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(c) determining if the active queue is full, if the active queue is not full extracting the command node from the ready queue and inserting the command node in the active queue.

5 15. The method of claim 14, further comprising:

(d) determining if a command node is being requested by the microprocessor, if a command node is being requested by the microprocessor extracting the command node from the active queue and inserting the command node into a free list.

10 16. The method of claim 12, wherein the insert queue, the sorted queue, and the ready queue each comprises a doubly-linked list of command nodes.

15 17. The method of claim 12, wherein the computing system comprises a disc drive microprocessor and an associated memory and where the command node comprises a command node for implementing a read/write command in the disc drive.

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18. Computer-readable media having stored thereon:

an insert queue;

a sorted queue;

a ready queue;

5 a plurality of queue managers, each queue manager comprising microprocessor-executable code operable for directing a microprocessor, the plurality of queue managers including:

a command queue manager operable for populating command nodes with command data and for inserting populated command nodes into the insert queue;

10 an insert queue manager operable for determining whether a command node within the insert queue collides with a command node in the sorted queue, for correcting any collisions between a command node within the insert queue and a command node in the sorted queue, and for extracting a non-colliding command node from the insert queue and inserting the non-colliding command node into the sorted queue;

15 a sorted queue manager operable for selecting an optimal command node from the sorted queue in accordance with a predefined sorting scheme; and

a scheduler for scheduling the execution of the queue managers in a microprocessor.

20 19. The computer-readable media of claim 18, wherein the sorted queue manager is further operable for extracting the selected command node from the sorted queue and inserting the selected command node into the ready queue.

25 20. The computer-readable media of claim 18, further having stored thereon an active queue and a ready queue manager, the ready queue manager being operable for extracting a preferred command node from the ready queue and for inserting the extracted preferred command node into the active queue.

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21. The computer-readable media of claim 20, further having stored thereon a free list queue and an active queue manager operable for extracting a requested command node from the active queue and for inserting the requested command node into the free list queue.

5        22. The computer-readable media of claim 17, wherein the insert queue, the sorted queue, and the ready queue each comprises a doubly-linked list of command nodes, and wherein each of the command nodes includes data for implementing a read/write command in a microprocessor of a disc drive device.

PROTECTIVE ORDER

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23. A system for managing command nodes in a computing device comprising:  
a microprocessor;  
computer-readable media;  
a data structure stored on the computer-readable media, the data structure comprising:  
5 an insert queue comprising a command node;  
a sorted queue comprising a command node selected from the insert queue; and  
a ready queue comprising a command node selected from the sorted queue  
according to an predefined optimization scheme.

10 24. The system of claim 23, wherein the sorted queue includes only non-colliding  
command nodes.

15 25. The system of claim 24, further including an active queue including a command  
node selected from the ready queue.

20 26. The system of claim 25, wherein the active queue comprises includes two  
command nodes both of which are accessible by the microprocessor.

25 27. The system of claim 25, further including a free list queue from which  
command nodes have been extracted, populated with command data, and inserted into the  
insert queue.

28. The system of claim 23, wherein each of the queues is structured as a doubly-  
linked list having a head and a tail.

29. The system of claim 28, wherein each queue has an associated head pointer  
which points the command node at the head of the associated queue and an associated tail  
pointer which points the command node at the tail of the associated queue.

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30. The system of claim 29, wherein the microprocessor includes a plurality of registers and wherein each of the head pointers and each of the tail pointers is stored in an associated register in the microprocessor.

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31. A queue processing system for managing a plurality of command node queues in a data storage device comprising:

- a microprocessor; and
- a queue processing means for controlling the position and flow of command nodes within and through the plurality of command queues.

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